

**GTU nano 2021: SHORT CHRONICLE AND PHOTO AND  
SCREENSHOT GALLERY. 6th INTERNATIONAL CONFERENCE  
“NANOTECHNOLOGY” IN MEMORY OF PROFESSOR ALEX  
GERASIMOV – INITIATOR OF GTU’S NANOCONFERENCES**

*Nanotechnology is known as one of the present-day disrupting technologies, which are able to change the life of a society essentially.*

**L. Chkhartishvili**

To overcome the challenges of the Covid–19 pandemic situation – the difficulties of traveling to other countries, the need to maintain distance and others requirements, the broad perspective of virtual meetings is obvious for good communication in the research areas.

In this chronicle, we present some mini-stories and screens/photos from the virtual meeting of the 6th International Conference “Nanotechnology” – GTU nano 2021, held in Tbilisi, Georgia, at October 4 – 7, 2021, organized by the Georgian Technical University (GTU). This Conference was dedicated to the memory of well-known Professor Alex Gerasimov – initiator of GTU’s regular nano-conferences in Georgia.

The International Scientific Committee of the GTU nano 2021 was very representative, presented by famous scientists from various countries, universities, institutes, research centers in the field of nanotechnology. Numerous well-known and also young researchers/participants and experts from Armenia, Azerbaijan, Belarus, China, Czech Republic, Georgia, Germany, Hungary, India, Iraq, Italy, Japan, Kazakhstan, Mexico, Poland, Russia, Serbia, Turkey, Ukraine, and United States of America took part in this virtual conference.

**Committees**

GTU nano 2021 was conducted by the International Scientific Committee:

Chairman: David Gurgenidze (Georgia)

Vice-Chairman: Zurab Gasitashvili (Georgia)

Members: Rosa Abdulkarimova (Kazakhstan), Osman Adiguzel (Turkey), Khalid Al-Ammar (Iraq), Hossein Aminian (Canada), Hamlet Avetissian (Armenia), Rick Becker (USA), Stefano Bellucci (Italy), Galina Benemanskaya (Russia), Vladimir Berkovits (Russia), Dieter Bimberg (Germany), Levan Chkhartishvili (Georgia), Volodymyr Chumakov (Ukraine), Russell Dupuis (USA), Ahmed El-Saghier (Egypt), David Hui (USA), George Japaridze (Georgia), Bilgin Kaftanoglu (Turkey), David Katoshevski (Israel), Pawan Khanna (India), Boris Kharissov (Mexico), Laszlo Kotai (Hungary), George Kvesitadze (Georgia), Haldun Kurama (Turkey), Olena Lavrynenko (Ukraine), Sergey Maksimenko (Belarus), Fernand D. S. Marquis (USA), Roderick Melnik (Canada), Mustafa Muradov (Azerbaijan), Ivane Murusidze (Georgia), Archil Prangishvili (Georgia), Vladimir Sanin (Russia), Lina Sartinska (Ukraine), Gintautas Skripkiunas (Lithuania), Masatoshi Takeda (Japan), Klaus Thiessen (Germany), David Tomanek (USA), Onuralp Yucel (Turkey), Pawel Zukowski (Poland)

GTU nano 2021 was organized by the National Organizing Committee:

Chairman: Levan Chkhartishvili

Secretary: Mikheil Chikhradze

Members: Tamar Berberashvili, Amiran Bibilashvili, Tamar Bzhalava, Lali Chakhvashvili, Nikoloz Chikhradze, George Chiradze, Archil Chirakadze, Ketevan Davitadze, Guram Dgebuadze, Akaki Gigineishvili, Gela Goderdzishvili, Kakha Gorgadze, George Iluridze, Nikoloz Jalabadze, George Japaridze, Zurab Jibuti, David Jishiashvili, Tinatin Kaishauri, Paata Kervalishvili, Ketevan Kotetishvili, Tamar Lominadze, Parmen Margvelashvili, Levan Matsaberidze, Vladimer Mikelashvili, Tamaz Minashvili, George Nabakhtiani, Lili Petriashvili, Shota Sidamonidze, Otari Shonia, David Tavkhelidze, Michael Vepkhvadze, Otari Zumburidze

### Short history

The international conferences on nanotechnology have been regularly held in Georgia since 2010 every two years, attracting professionals working in various related fields, including nanotechnology, nanophysics, nanochemistry, nanobiology, nanomedicine, nanomaterials, nanoengineering, nanoelectronic, nanosafety, nanoeducation, etc.

Nano – 2010: 1st International Conference “Nanochemistry – Nanotechnologies”, 2010 March 23 – 24, Tbilisi, Georgia

Nano – 2012: International Scientific Conference “Basic Paradigm in Science and Technology Development for the 21st Century” dedicated to the 90th Anniversary of the Georgian Technical University. Special Section – 2nd International Conference “Nanotechnologies”, 2012, September 19 – 21, Tbilisi, Georgia

Nano – 2014: 3rd International Conference “Nanotechnologies”, 2014, October 20 – 24, Tbilisi, Georgia

Nano – 2016: 4th International Conference “Nanotechnologies”, 2016 October 24 – 27, Tbilisi, Georgia

Nano–2018: 5th International Conference “Nanotechnologies”, 2018 November 19 – 22, Tbilisi, Georgia

GTU nano 2021: 6th International Conference “Nanotechnology” in memory of Prof. Alex Gerasimov – initiator of GTU’s nanoconferences, 2021 October 4 – 7, Tbilisi, Georgia

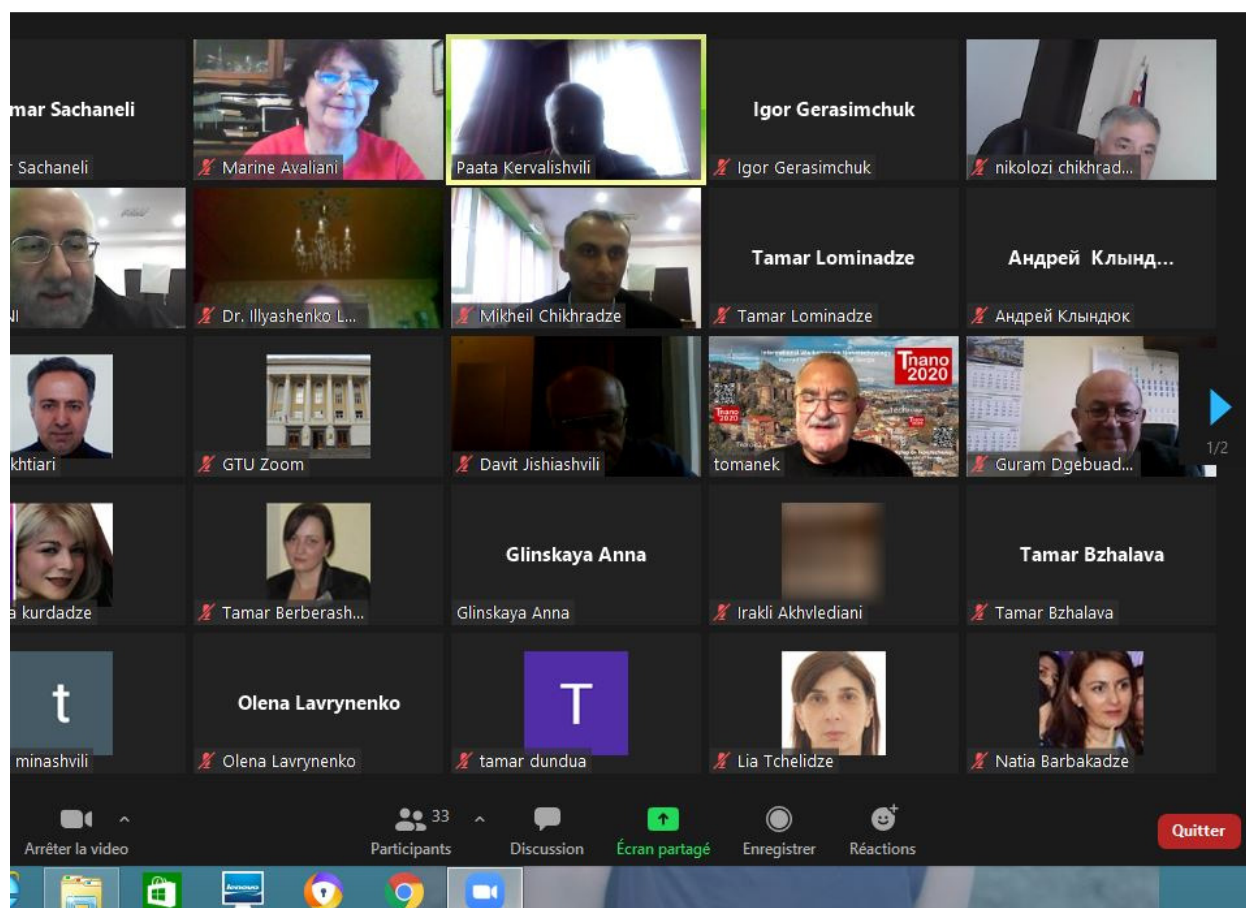
The said last Conference dedicated to the memory of Alex Gerasimov (1936 – 2019) was supposed to be held in 2020, but the pandemic situation did not allow it. Thanks to the significant efforts of the organizers of this scientific forum, it was decided to hold it in October, 2021 as a virtual meeting.

The list of invited papers and other information are available on the conference website: <http://www.nano2020.gtu.ge/>.

In total, the conference National Organizing Committee has received 105 abstracts of presentation. The submitted papers’ abstracts were published electronically in the Abstracts Book (Compilers: L. Chkhartishvili and M. Chikhradze):

<https://www.nanostudies.org/index.php/nano/article/view/14/61>.

Authors of the selected conference papers were invited for publication in following conference partner-journals: Nano Studies, European Chemical Bulletin, Journal of Pharmaceutical and Applied Chemistry and Eastern-European Journal of Enterprise Technologies.



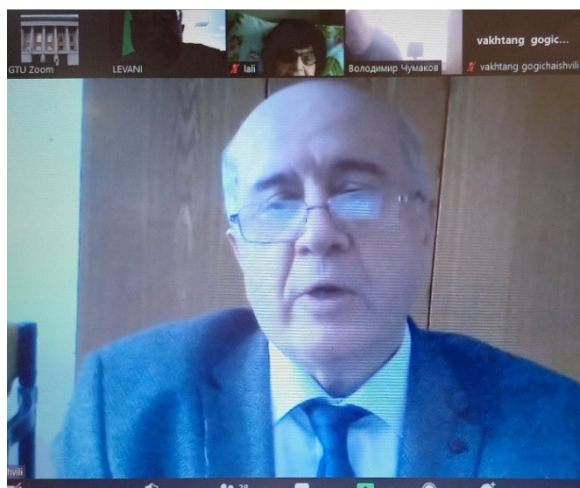
Screenshot of one of virtual meeting moments.

### Advancement of Conference

The virtual meeting was opened by Professor Zurab Gasitashvili, vice-Rector of the Georgian Technical University and Vice-Chairman of the GTU nano 2021's International Scientific Committee.

In his speech, he emphasized: “We hope that at this GTU's conference the main directions of future nano-research will be determined and the discussion held here will give a significant impact to mutually beneficial cooperation between universities and research centers of different countries in the development of new nanotechnologies. Professors and researchers in the field of nanotechnology of the GTU are ready to actively participate in the fruitful work of the conference. The 6th International Conference is dedicated to the blessed memory of the professor of our university – Alex Gerasimov. Professor Gerasimov as scientist, teacher, and organizer of production significantly contributed in development of nanotechnology and nanophysics, training of young personnel, and construction of the electronic industry in Georgia. He initiated the transfer of nanoconferences to GTU and afterwards made a lot of efforts for their successful implementation”.

Regarding other important points of the presentations, as Prof. Zurab Gasitashvili noted, the virtual sessions' program includes approximately 65 invited, oral and poster presentations. Organizers of this virtual meeting are honored that 40 leading scientists from 21 countries have agreed to join in the conference International Scientific Committee – many thanks to all of them for their assistance and contribution.

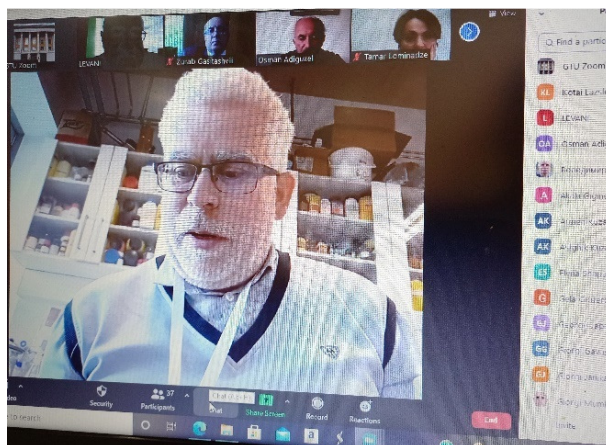


**Prof. Zurab Gasitashvili's opening speech.**

He also warmly thanked the National Organizing Committee for their hard work carried out during the preparation of the Conference.



**Conference organizers and session chairs  
Prof. L. Chkhartishvili and Dr. M. Chikhradze.**



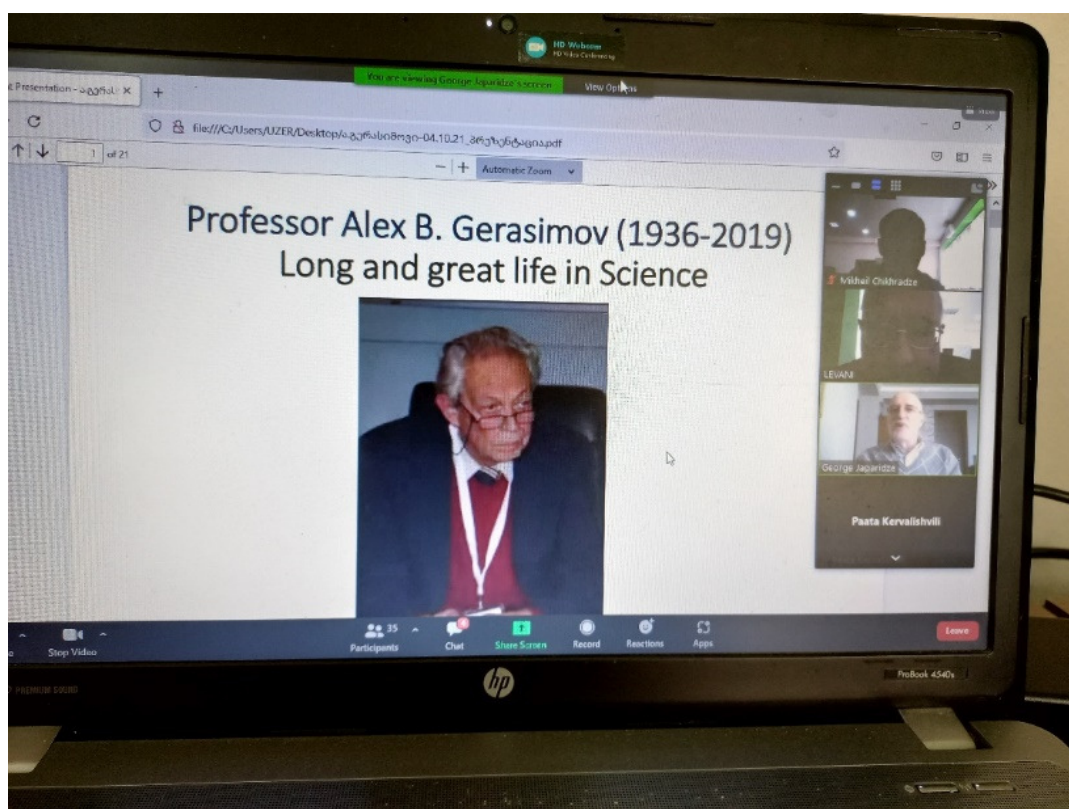
**Greetings from Dr. Laszlo Kotai (Hungary).**



Among the well-known scientists who cordially greeted all contributors of virtual meeting via Zoom was Dr. Laszlo Kotai (Hungary). He wished the organizers and moderators of the conference L. Chkhartishvili and M. Chikhradze a fruitful work.

### **Presentations and discussions**

At GTU nano 2021, the life path and scientific works of Professor Alex Gerasimov were presented by Academician George I. Japaridze, Academician-Secretary of Department of Mathematics and Physics of the Georgian National Academy of Sciences and Professor of the Ilia State University, Tbilisi, Georgia.



**Long and great life in science of Prof. Alex Gerasimov.**

Alex Gerasimov lived and worked in Tbilisi. A. Gerasimov completed his MSc in Physics at 1959 and obtained Doctor's Degree at 1988. Having been involved in materials research for about six decades, A. Gerasimov also worked as Researcher and then Chair of Department and Scientific-Research Laboratory of Semiconductor Microelectronics at the Tbilisi State University and Head of Laboratory at the Scientific Institute of Microelectronics. In the last decade, A. Gerasimov worked as a Professor in the Department of Engineering Physics at the Georgian Technical University. He was Scientific Director of the Gerasimov Research Laboratory at the Representative Office in Georgia of the Liquid Light Inc., Seattle, USA.

Alex Gerasimov worked not only in academic domain, but also in microelectronic industry: he was Deputy Director and Chief Engineer of the Industrial-Scientific Association 'Mion'. According to the recollection of his 'Mion' colleagues, he was fair, honest, probing, cultivated, exigent, but objective and impartial man. A. Gerasimov developed his proficiency in

the fields of solid state physics, semiconductors, microelectronics, nanophysics, nanotechnology, etc. He has (co)authored more than 240 publications and several invention patents. In 1998, his work “Exoelectronic Emission of Solids” was recognized as a scientific discovery.



**Alex Gerasimov at 4th International Conference “Nanotechnologies”, 2016  
October 24 – 27, Tbilisi, Georgia (Nano – 2016).**



**Alex Gerasimov at 6th International Conference and Exhibition on Nano and Advanced Materials,  
2018 August 6 – 8, Quebec-City, Canada (ICANM 2018).**

When reflecting on the personality and life of Alex Gerasimov one could sum up with writer’s words: “Don’t be sad, that he is gone, but rejoice that he lived and was so creative”.

In his last years, Alex Gerasimov intensively developed own Molecular-Potential Theory or Electron-Potential Theory of Substance. At GTU nano 2021, the prospects for Gerasimov’s molecular-potential approach to nanotechnology were presented by Professor Levan Chkhartishvili (Georgian Technical University, Tbilisi, Georgia).

Actually, it is not a theory, but a powerful semiempirical method allowing a quite good general description of the complex of physical properties of substances, in particular, nanomaterials. According to the Gerasimov’s molecular-potential approach, all the properties of a substance are determined by the chemical bonds between constituent atoms. In the equilibrium, all the valence electrons are in bonding states. But, under various external influences part of them transits into the anti-bonding states. It changes the system properties. In nanomaterials, ratio of numbers of surface and bulk atoms strongly exceeds that for macroscopic

specimen of same material. Accordingly, because of breaking chemical bonds in nanomaterials are palpably weakened. This explains changes in materials' properties at increasing in their dispersity. As for the validity limits, for Gerasimov's molecular-potential approach, they should be defined in the near future.

### Session 1 – Chairs: Levan Chkhartishvili and Mikheil Chikhradze

Invited speakers and/or virtual presenters defined the following attention-grabbing themes: “Microstructural characterization of structural phase transformations in shape memory alloys” (O. Adiguzel, Firat University, Turkey); “Modification of clay rocks for obtaining a highly active pozzolanic admixture” (E. Shapakidze, Tbilisi State University, Georgia); “Adsorption and photodegradation of quinoline yellow, ponceau 4R and brilliant blue FCF onto ZnAl LDH–LDO/PVA nanocomposite” (O. O. Balayeva, Baku State University, Azerbaijan); “Single-photon thermoelectric detector with Bi(Pb)-2223 superconducting thin film layers” (A. Kuzanyan, Institute for Physical Research, Armenia); “Spiropyrans with negative photochromism for nanotechnology” (L. Devadze, Institute of Cybernetics, Georgia); and “Nanocomposite hydrogels and its application for environmental remediation” (H. Kurama, Eskisehir Osmangazi University, Turkey).



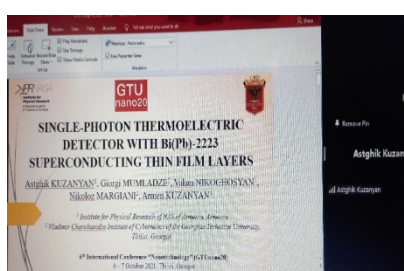
**Chair Prof. Levan  
Chkhartishvili (Georgia).**



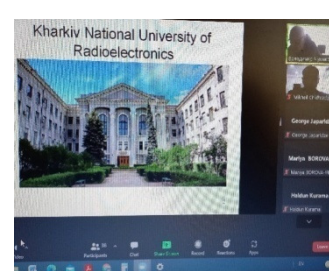
**Chair Dr. Mikheil  
Chikhradze (Georgia).**



**Invited Speaker Prof.  
Osman Adiguzel (Turkey).**



**Presentation by Dr.  
Astghik Kuzanyan (Armenia).**



**Presentation by Prof.  
Volodymyr Chumakov (Ukraine).**

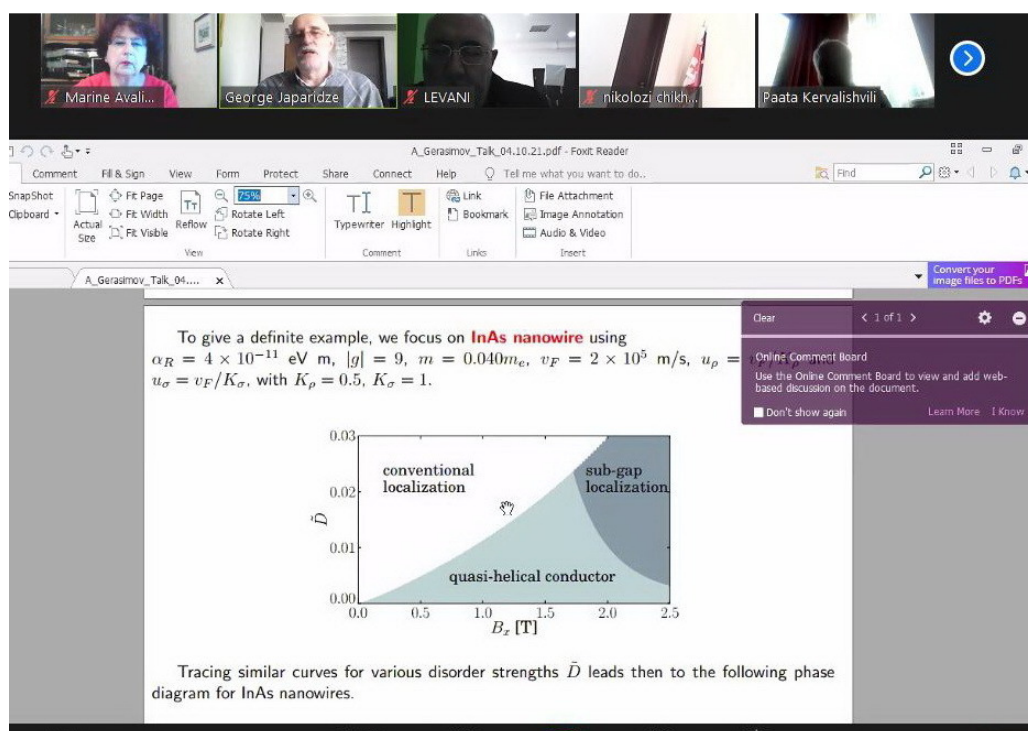
A great interest of the participants of the meeting was aroused by presentations made by speakers from Ukraine: “Biosynthesis of luminescent Ag<sub>2</sub>S quantum dots and study of their optical features and genotoxic effects” (M. Borova, Institute of Food Biotechnology and Genomics, Ukraine) and “On the model of bactericidal action of UV radiation” (V. Chumakov, Nat. Univ. of Radioelectronics, Kharkiv, Ukraine).

## Session 2 – Chairs: Paata Kervalishvili and Ivane Murusidze

At the second session, first it was presented a very interesting topic: “Unconventional metallic phases in a quantum wire with modulated spin–orbit coupling” (G. I. Japaridze, Ilia State University, Georgia).



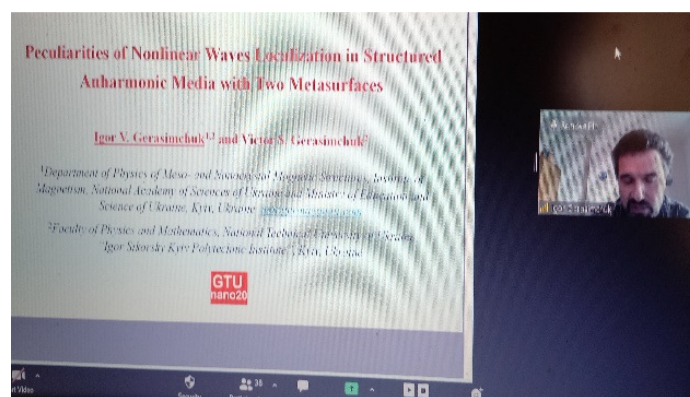
Chair Prof. Paata Kervalishvili.



Invited Presentation by Prof. George I. Japaridze (Georgia).

After living discussions on this invited presentation – during of the aforementioned session, the following themes were presented: “Preparation of graphene oxide composites containing nanosized silver, copper, and titanium oxide and study of their biocidal properties” (T. Dundua, Georgian Technical University, Georgia); “New achievements in thermotherapy” (G. Gavashelishvili, Georgian Technical University, Georgia); “Peculiarities of nonlinear waves localization in structured anharmonic media with two metasurfaces” (I. V. Gerasimchuk, Institute of Magnetism, Ukraine); “On the quantification of the striatum neurochemical profile using steam MRS: A comparison of 3T versus 7T in a cohort of elderly subjects” (A. Gogishvili, Institute of Neuroscience and Medicine 4, Germany).



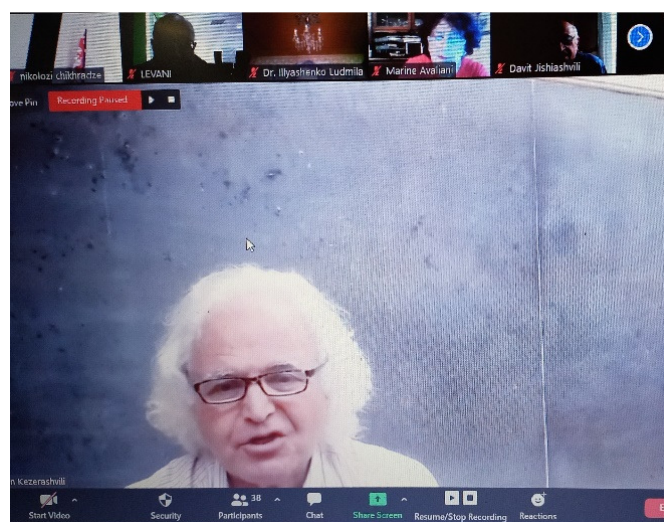


Presentation by Dr. Igor V. Gerasimchuk (Ukraine).

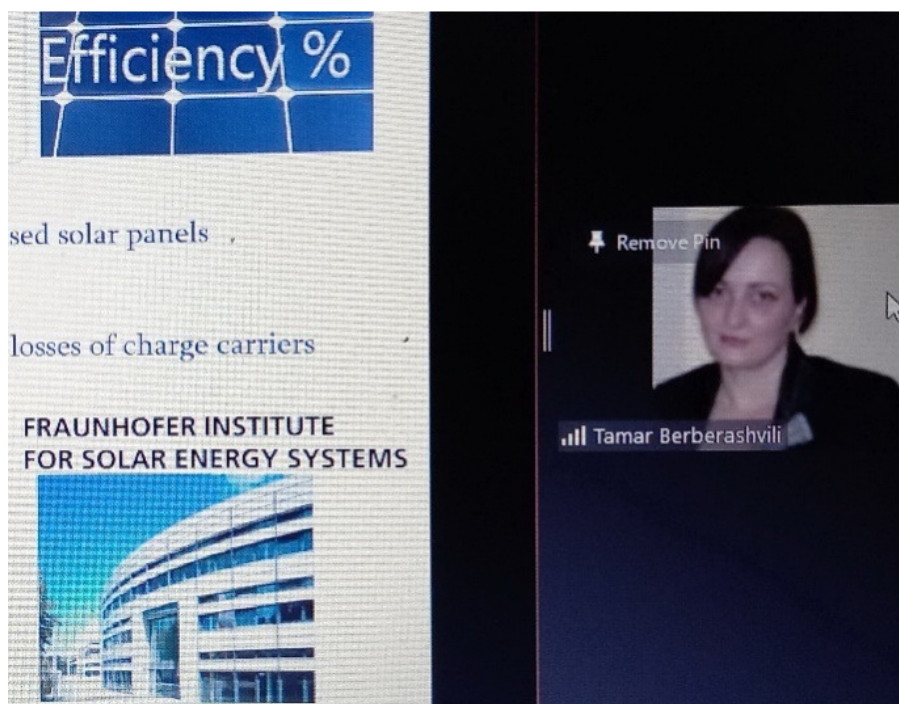


Presentation by Dr. Ana Gogishvili (Germany).

The interesting topics were discussed via bright presentations: “Pseudo-protein-based nanoparticles show promise as carriers for ophthalmic drug delivery” (T. Kantaria, Agricultural University of Georgia, Georgia) and “Magnetoexcitons in novel two-dimensional materials in monolayers, bilayer, and van der Waals heterostructures” (R. Ya. Kezerashvili, City University of New York, USA).

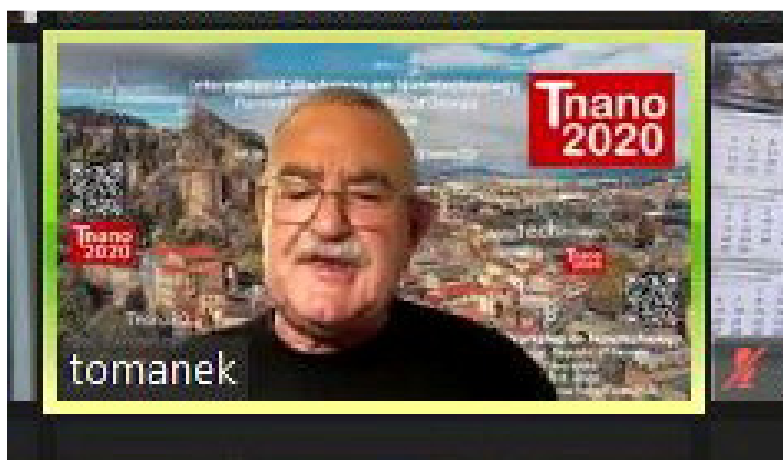


Presentation by Prof. Roman Ya. Kezerashvili (USA).



**Presentation by Dr. Tamar Berberashvili (Georgia).**

During this session, studies of remarkable quality were presented, giving rise to debate and exchange: “The sonochemical synthesis of PVA/Mg–Al–OH layered double hydroxide nanocomposite film” (K. Ibrahimova, Baku State University, Azerbaijan); “Composite bionanomaterial for creating a strain sensor” (L. Ichkitidze, National Research University of Electronic (MIET), Russia); “Penetration depth of electromagnetic wave in nanoparticles” (L. Illyashenko, Kharkiv National University of Radio Electronics, Ukraine); “Branched ZnO microcrystals. A scanning electron microscopy study” (A. Jishiashvili, Institute of Cybernetics, Georgia); “Silicon–graphene based solar elements” (T. Berberashvili, GTU, Georgia); and “Progress in water desalination: Insight from ab initio studies” (D. Tomanek, Michigan State University, USA).



**Presentation by Prof. David Tomanek (USA).**

**EXCITON AND POLARITON PHASES IN BUCKLED TWO-DIMENSIONAL MATERIALS**

**Matthew N. Brunetti, Oleg L. Berman, and Roman Ya. Kezerashvili**

*New York City College of Technology,  
The City University of New York*

*The Graduate School and University Center  
The City University of New York,  
New York, USA*

The work was supported by US Department of Defense under Grant No. W911NF1810433.

**Invited Presentation by Prof. Oleg L. Berman (USA).**

By Oleg L. Berman (City University of New York, USA) was discussed the “Exciton and polariton phases in buckled two-dimensional materials”.

### **Session 3 – Chairs: George Japaridze and David Jishiashvili**

On the second day of the Conference the following very noteworthy issues were addressed and debated.

**LASER TECHNOLOGIES OF NANOSYSTEMS PREPARATION**

**Paata J. KERVALISHVILI**

Engineering Physics Department, Georgian Technical University, Tbilisi, Georgia,

International Conference “Nanotechnology”, 4 – 7 October 2021, Tbilisi, Georgia. G T U n a n o 2 0 2 1

**Invited Presentation of Prof. Paata J. Kervalishvili (Georgia).**

In particular, following themes were presented: “General characteristics of nanoparticles formed in iron-based systems and perspectives their biomedical application” (O. Lavrynenko,



Frantsevich Institute for Problems of Material Science, Ukraine); “Silver–silver sulphide hybrid nanowires: Fabrication, structure and physical properties” (M. B. Muradov, Baku State University, Azerbaijan); “Beyond the Dirac cones: Zero effective mass carriers in 2D materials with hyperboloid conduction bands” (I. G. Murusidze, Ilia State University, Georgia); and “Laser technologies of nanosystems preparation” (P. J. Kervalishvili, Georgian Technical University, Georgia).

Afterwards, a remarkable topic was presented by Georgian authors: “Synthesis of nanostructure high entropy alloys in Fe–W–Al–Ti–Ni–C–B system” (M. Chikhradze, Mining Institute, Georgia).

The discussions on the above topic were followed by valued presentations by colleagues from Hungary and the USA: “Plasma-assisted preparation of nano-ZrC@C composites from Zr-loaded sulphonated styrenedivinylbenzene co-polymers” (A. Martiz, Budapest University of Technology and Economics, Hungary) and “Carbon nanotubes and graphene hybrid materials systems for multifunctional applications in energy and environment” (F. D. S. Marquis, San Diego State University, USA).

#### Session 4 – Chairs: Levan Chkhartishvili and Mikheil Chikhradze

A very impressive and attractive Invited Presentation from Japan was entitled: “Morphologically designed novel nanocarbon materials derived from highly stable SWCNT inks” (K. Kaneko, Shinshu University, Japan).

**6TH INTERNATIONAL CONFERENCE "NANOTECHNOLOGY" – GTUnano 2021**  
DEDICATED TO THE MEMORY OF PROF. ALEX GERASIMOV — OCTOBER 4-7, 2021, TBILISI, GEORGIA

**DEVELOPMENT OF COMPOSITIONS OF GEOPOLYMER BINDERS BASED ON ROCKS OF GEORGIA**  
E. SHAPAKIDZE<sup>1</sup>, M. AVALLIANI<sup>2</sup>, M. NADIRASHVILI<sup>1</sup>, V. MAISURADZE<sup>1</sup>, I. GEJADZE<sup>1</sup>, T. PETRIASHVILI<sup>1</sup>  
<sup>1</sup> Alexander Tvalchrelidze Caucasian Institute of Mineral Resources, Ivane Javakishvili Tbilisi State University, Tbilisi, Georgia  
<sup>2</sup> Raphael Agladze Institute of Inorganic Chemistry and Electrochemistry, Ivane Javakishvili Tbilisi State University, Tbilisi, Georgia

Global growth in OPC production is inevitably accompanied by an increase in the negative anthropogenic impact on the planet's ecology and irrational consumption of energy carriers. One of the ways to solve these problems is the use of geopolymers – alkali-activated aluminosilicate binders based on local non-deficient rocks and granular slags of the metallurgical industry.

The purpose of this work is to study the clay rocks of Georgia for the synthesis of geopolymer binders. For the study were used clay rocks widespread in Georgia: shale, argillite and fusible clay [1-5].

Table 1 shows the chemical compositions of the studied materials.

**Table 1. The chemical composition of clay rocks, wt. %**

No.	LOI	SiO <sub>2</sub>	TiO <sub>2</sub>	Al <sub>2</sub> O <sub>3</sub>	Fe <sub>2</sub> O <sub>3</sub>	FeO	Mn <sub>2</sub> O <sub>3</sub>	CaO	MgO	SO <sub>2</sub>	Na <sub>2</sub> O	K <sub>2</sub> O
1	4.50	59.95	0.89	17.30	3.45	3.65	0.59	1.53	2.43	0.30	2.20	2.20
2	7.01	47.19	-	15.90	13.36	-	0.10	6.30	4.10	1.39	2.86	1.30
3	10.60	52.84	-	15.07	6.47	-	-	7.06	2.49	1.36	1.19	2.17

Below are photomicrographs of the studied clay rocks.

**Fig. 5. The kinetics of CaO absorption by heat-treated clay rocks from a saturated solution:**  
a) shale, b) argillite, c) clay

Heat treatment (modification) of clay materials was carried out in a muffle furnace at a heating rate of 250-300 °C per hour and at an exposure time of 1 hour at a maximum temperature of 700 °C. The samples were cooled naturally at room temperature.

For the preparation of geopolymer compositions, granulated blast furnace slag and modified clay rocks were used.

**Table 2. Compositions of geopolymer binders and the results of physical and mechanical testing**

No.	Components (%)	Alkaline component, (dry matter above 100%), %	Compressive strength after 28 days of curing depending on curing conditions, kg/cm <sup>2</sup>			Compressive strength after heat treatment, kg/cm <sup>2</sup>
			Air	Water	Air-wet	
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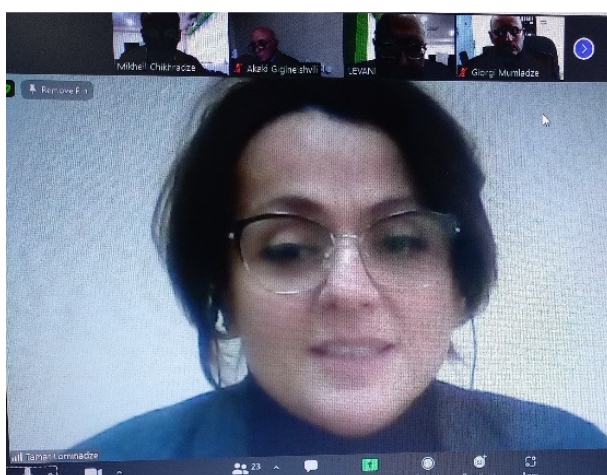
#### Presentation by Elena Shapakidze, Marina Avaliani, et al. (Georgia).

Several poster presentations from numerous countries were demonstrated by authors: E. Shapakidze, N. Barbakadze, D. O. Derecha, I. V. Gerasimchuk, A. Ghazaryan, A. Glinskaya, L. P. Ichkitidze, L. Illyashenko, Z. U. Jabua, M. M. Muradov, E. Khutsishvili, A. Klyndyuk, I. Kvartskhava, V. Leonov, N. Matvieva, O. O. Balayeva, N. Poyedinok, O. Ryazanova, H. Sauchuk, T. Shitchkova, E. Yukhno and Sh. Makatsaria.



Discussions around the presentations and closing remarks were conducted with professionalism and success by the Session Chair, Prof. Levan Chkhartishvili. He noted: “Conference was a forum of nanoscientists for broad interdisciplinary discussions and, therefore, not only intensified the actual collaboration, but also facilitated the future developments of international cooperation in nanotechnology research.”

Session Chair, Dr. Mikheil Chikhradze was, as always, very friendly and positive and he cordially thanked all participants.



**Prof. Tamar Lominadze's closing speech.**

The closing speech was given by Prof. Tamar Lominadze, Dean of the Faculty of Informatics and Control Systems of the GTU, who thanked all participants and contributors of the GTU nano 2021 Conference.



**View of author's garden.**

All contributors of the 6th International Conference “Nanotechnology” agree that despite the situation with Covid–19 and several related difficulties, this virtual Zoom-meeting was a high-level scientific forum, which served for a broad scientific exchange between researchers and/or experts in the field of nanoscience.

The conference will hopefully lead to establish and develop a fruitful cooperation between different research institutions, as well as among scientists and technologists. In the situation of almost global isolation and/or distancing (in the direct or indirect sense of the word) it is essentially needed to conduct virtual discussions, meetings in order to exchange ideas and to communicate different scientific achievements.

### **Acknowledgements**

We would like to warmly thank the organizers and chairs of the 6th International Conference “Nanotechnology” (GTU nano 2021): Levan Chkhartishvili, Mikheil Chikhradze, Paata Kervalishvili, Ivane Murusidze, George Japaridze, David Jishiashvili and all the participants/contributors to virtual meeting.

The conference is over, but the space for further discussion is open ...

***Marina Avaliani***

PhD, Research Group Leader  
Rafael Agladze Institute of Inorganic Chemistry and Electrochemistry  
Ivane Javakhishvili Tbilisi State University  
Tbilisi, Georgia  
[avaliani21@hotmail.com](mailto:avaliani21@hotmail.com)

**November 29, 2021**